

provisional application 60/224,387 filed August 9, 2000. Applicant respectfully requests the Examiner acknowledge said priority claim in the next communication to Applicant.

In view of the following amendments and remarks, the Applicant respectfully requests the Examiner to reconsider and withdraw the outstanding objections and rejections and allow all claims pending in this application.

AMENDMENT

Please amend the above captioned application as follows:

In the Claims:

Please amend the claims as shown in Attachment "A".

REMARKS

Claims 1-12 are pending in the application and are presented for reconsideration and further examination in view of the foregoing amendments and following remarks.

In the outstanding Office Action claims 1, 2, 4-6, and 12 were rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 4,598,330 to Woodworth; claims 1-4, 7, and 12 were rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 4,959,746 to Hongel; claims 8-10 were rejected under 35 U.S.C. § 103(a) as obvious the Hongel '746 patent in view of U.S. Patent No. 5,822,563

to Sitbon et al.; and claim 11 was objected to as dependent on a rejected base claim.

By this Response and Amendment claims 1 and 12 are amended to clarify the invention as discussed in the interview with the Examiner. As amended the rejections are traversed and arguments in support of the traversal are provided.

Support for the amendments to claims 1 and 12 is found in the application as originally filed.

It is therefore respectfully submitted that the above amendments introduce no new matter within the meaning of 35 U.S.C. § 132.

Rejections Under 35 U.S.C. § 102

The Examiner rejected claims 1, 2, 4-6, and 12 as anticipated by the Woodworth '330 patent; and rejected claims 1-4, 7, and 12 as anticipated by the Hongel '746 patent.

RESPONSE

Independent claims 1 and 12 have been amended as discussed during the interview to clarify the invention. As amended the rejections are respectfully traversed.

The test for anticipation under section 102 is whether each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.

Verdegaal Bros. v. Union Oil Co. of California, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987); MPEP §2131. The identical invention must be shown in as complete detail as is contained in the claim. *Richardson v. Suzuki Motor Co.*, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989); MPEP §2131. The elements must also be arranged as required by the claim. *In re Bond*, 15 USPQ2d 1566 (Fed. Cir. 1990).

The instant invention, as claimed in claims 1 and 12, is directed to a DC arc-suppression circuit (claim 1) and corresponding arc-suppression method (claim 12) having an electro-mechanical relay with a relay contact that provides for direct current (DC) electricity to be controlled between a power source and an electrical load. An inductive armature opens and closes the relay contact. A power transistor is connected in electrical shunt with the relay contact and has an input for controlling a shunt current. A timing circuit is electrically connected to the inductive armature and is connected to the input of the power transistor. A power-control signal input is electrically connected to the timing circuit such that **when the timing circuit receives a command from the power-control signal input to interrupt a flow of power from the power source to the electrical load, the timing circuit first turns the power transistor on in response to the command, then opens the relay contact, and then turns the power transistor off.** (claim 1). A control signal to disconnect a load from a source of direct current is received. The direct current is

shunted around a pair of closed contacts in the electro-mechanical relay through the solid-state semiconductor device in response to the control signal to clamp the open-circuit voltage across the pair of contacts under load. (claim 12).

Rejection of Claims 1 and 12 based on the Woodworth '330 patent

Applicant respectfully submits that the Woodworth patent does not disclose a power-control signal input electrically connected to the timing circuit such that when the timing circuit receives a command from the power-control signal input to interrupt a flow of power from the power source to the electrical load, the timing circuit *first turns the power transistor on in response to the command*, then opens the relay contact, and then turns the power transistor off.

To the contrary, in the Woodworth patent the power transistor is turned on in conjunction with the closure of the relay contacts in response to a turn ON signal and remains on in parallel with the relay contacts while the relay is conducting the DC and is thereafter turned off after the relay contacts are opened.

More particularly, the Woodworth patent discloses at col. 6, lines 33-40, that to turn on the Hexfet device, Q103/Q104, a transistor Q2 supplies a voltage to the gate of the two Hexfet transistors. This is done after a brief delay to verify that the voltage at the node E9 is in fact rising, and it is also done to

minimize interference from static or noise spikes. When Q2 is switched on and supplies voltage to the gates of the two Hexfet devices Q103 and Q104, the devices Q103 and Q104 go into conduction. Woodworth further discloses at col. 7, lines 50-68, and particularly at lines 64-68, that "as long as the relay K2 has its coil energized by current from the transistor Q102, gate current is being supplied to the SCR device SCR101 and therefore the SCR device will remain in conduction."

"After the SCR device SCR101 started conduction and after the contacts K2-A1 and K2-A2 of the relay K2 were closed, the circuit is considered to have been switched on. In the short interval of time between the turn-on of the SCR device SCR101 and the closure of the contacts K2-A1 and K2-A2 of the relay K2, the capacitive timing delays driving the comparators U1C and U1D of the high voltage section 4 have provided a turn-on signal to the gates of the Hexfet devices Q103 and Q104. The Hexfet device provides a third path in the sequence. The SCR device SCR101 turns on first, the Hexfet devices Q103 and Q104 turn on second, and the relay K2 has its contacts A1 and A2 turn on third. **This provides three parallel paths for the load current, although virtually the entire current will be flowing through the relay contacts K2-A1 and A2 when the circuit is fully on.**" [Emphasis added.]

Woodworth additionally discloses at col. 8, lines 15-59, that "when the optocoupler U2 is turned off by the low voltage section

2, or if the high voltage input at the terminals J1-A1 and J1-A3 falls below approximately 100 volts turning off the comparator U1A, the operation of the circuit will be provided with a sequential turn-off. This turn-off occurs as follows."

"As soon as the transistor pair Q3 and Q102 turn off, the current to the gate of the SCR device SCR101 is almost instantaneously removed. At this point, with no voltage drop across the cathode-anode path of the SCR device and with no gate current being supplied to the gate of the SCR device, the SCR device SCR101 essentially turns off. The contacts of the K2 relay A1 and A2 however, are still closed for about five to 10 milliseconds. The Hexfet transistor pair Q103 and Q104 are still supplied with a gate potential from the capacitor C8 which has charge stored on it. The current requirements for the gates of the Hexfet transistors is almost zero, which is a useful characteristic since it provides the useful benefit that a stored charge on the gate is capable of keeping it operating even though the power sources to the circuit have been lost. The contacts A1 and A2 of the relay K2 begin to open. At this point, there is approximately a 30 millisecond delay before the Hexfets Q103 and Q104 turn off. The two parallel Hexfets effectively shunt the load current around the K2 relay contacts A1 and A2 and around the SCR device SCR101 until the relay contacts K2-A1 and K2-A2 are fully separated. This provides proper operation for the circuit since all of the current

at this point is carried by the Hexfets Q103 and Q104. This minimizes any voltage across the open contacts K1-A1 and K1-A2 as they open, preventing any unnecessary arcing. The effective voltage across the relay contacts K1-A1 and K1-A2 as they open under this sequence of operations, is merely a few volts. During this interval, the SCR device SCR101 does not see a large time rate of change of voltage across its cathode-anode path since the Hexfet devices Q103 and Q104 are conducting, and therefore it is not excited into conduction."

"Approximately 30 milliseconds later, the comparator U1C and U1D turns off the gate of the two Hexfet transistors Q103 and Q104 by clamping their gate potential to ground potential."

Claims 1 and 12 are therefore asserted to be patentable over the Woodworth patent. Claims 2, and 4-6, each ultimately dependent from claim 1, are asserted to be patentable over the Woodworth patent for at least the same reasons that claim 1 is patentable thereover.

Accordingly, reconsideration and withdrawal of the rejections is respectfully requested.

Rejection of Claim 1 based on the Hongel '746 patent

Applicant respectfully submits that the Hongel patent does not disclose a timing circuit electrically connected to an inductive armature and connected to an input of the power transistor, and a

power-control signal input electrically connected to the timing circuit such that when the timing circuit receives a command from the power-control signal input to interrupt a flow of power from the power source to the electrical load, the timing circuit first turns the power transistor on in response to the command, then opens the relay contact, and then turns the power transistor off, as claimed in claim 1.

To the contrary, Hongel discloses in Fig. 1 a first timing circuit (R-C circuit 54, 56 and multivibrator 42; see col. 4, lines 51-52 and col. 4, line 31) and a second timing circuit (diode 58 coupled through capacitor 60 to multivibrator 44; see col. 5, lines 10-20) inductively coupled to relay coil 10A and inductively coupled therethrough to the collector-emitter circuit of control transistor 14. Relay 10A-10B has its coil 10A connected between DC voltage source 12 and the collector of transistor 14. The emitter of transistor 14 is grounded. A control signal is applied to a power-control signal input terminal (base 16) of transistor 14. See col. 3, lines 52-63.

The Hongel patent does not disclose **a timing circuit electrically connected to an inductive armature and connected to an input of the power transistor, and a power-control signal input electrically connected to the timing circuit** as claimed in claim 1. Claim 1 is therefore asserted to be patentable over the Hongel patent. Claims 2-4 and 7, each ultimately dependent from claim 1,

are asserted to be patentable over the Hongel patent for at least the same reasons that claim 1 is patentable thereover.

Accordingly, reconsideration and withdrawal of the rejections is respectfully requested.

Rejection of Claim 12 based on the Hongel '746 patent

Applicant respectfully submits that the Hongel patent does not disclose receiving at a control-signal input a control signal to electrically disconnect a load from a source of the direct current; shunting the direct current around a pair of closed contacts in an electro-mechanical relay through a solid-state semiconductor device in response to the control signal; opening the pair of contacts in the electro-mechanical relay after shunting the direct current; and turning off the solid-state semiconductor device by a timing circuit electrically connected to the control-signal input after opening the pair of contacts, as claimed in claim 12.

To the contrary, Applicant submits that at most Hongel discloses discontinuance of a control signal to **connect** a load to a source of direct current. The Hongel patent discloses at col. 3, lines 57-60 that a control signal applied to transistor base terminal 16 causes the circuit to be completed through operating coil 10A and transistor 14 for the purpose of closing the contacts 10B. Hongel further discloses at col. 4, line 63 - col 5, line 7, that "[w]hen a positive going transient appears at terminal 48 as

a result of power being applied to relay operating coil 10A, multivibrator 42 immediately turns on by switching from its stable state to its unstable state. This substantially precedes the actual change in the circuit-completing contacts 10B (closing in this case). The Q output of multivibrator 42 is coupled to field effect transistor 26 and the field effect transistor turns on to provide shunting of the contacts 10B before they close. The time constant of the resistor 54-capacitor 56 combination is set so as to retain the multivibrator 42 in its unstable condition until the contacts 10B are completely closed, allowing time for contact bounce.

Hongel further discloses at col. 5, lines 21-37, that "[w]hen a negative going spike appears across winding 46, indicating the discontinuance of power to coil 10A as by the cessation of conduction through transistor 14, the negative going transient returns the trigger input of multivibrator 44 to ground from Vdd by means of charged capacitor 60 for initiating the unstable period of the multivibrator. As soon as the power to the relay coil is interrupted, multivibrator 44 substantially immediately fires and produces a positive going "Q" output coupled to the gate of field effect transistor 26 through diode 38. The field effect transistor 26 shunts contacts 10B before those contacts actually start to physically open. The time constant of the resistor 66-capacitor 68 circuit coupled to multivibrator 44 is chosen so that field effect

transistor 26 continues to conduct until contacts 10B have entirely separated and there is no possibility of arcing."

The Hongel patent does not disclose **receiving at a control-signal input a control signal to electrically disconnect a load from a source of direct current.** Furthermore, Hongel does not disclose turning off the solid-state semiconductor device **by a timing circuit electrically connected to the control-signal input** after opening the pair of contacts, as claimed in claim 12. Claim 12 is therefore asserted to be patentable over the Hongel patent.

Accordingly, reconsideration and withdrawal of the rejection is respectfully requested.

Rejections Under 35 U.S.C. § 103

The Examiner rejected claims 8-10 as obvious the Hongel '746 patent in view of the Sitbon et al. '563 patent.

RESPONSE

During the interview with Applicant's representative the Examiner withdrew the rejection of claim 8 and agreed to allow said claim, thereby rendering the rejections moot.

Claim Objection

Claim 11 was objected to as dependent on a rejected base claim but was indicated as being allowable if rewritten in independent

form to include the limitations of the base claim and any intervening claims.

RESPONSE

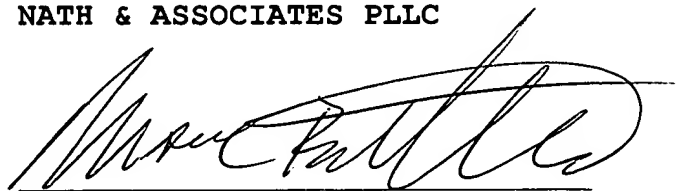
The Examiner's indication of allowable subject matter is noted with appreciation. Nevertheless, in view of the amendment to claim 1 and the arguments presented hereinabove, Applicant respectfully submits that claim 11 is allowable because claim 1 is now allowable

CONCLUSION

In light of the foregoing, Applicant submits that the application is in condition for allowance. If the Examiner believes the application is not in condition for allowance, Applicant respectfully requests that the Examiner contact the undersigned attorney if it is believed that such contact will expedite the prosecution of the application.

Respectfully submitted,

NATH & ASSOCIATES PLLC

A handwritten signature in black ink, appearing to read 'Robert C. Ryan', is written over a horizontal line.

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